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A REVIEW OF THE NORTH AMERICAN SPECIES OF *LINNAEMYA* SENS. LAT.

(DIPTERA, TACHINIDAE) *

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The name *Linnaemya* has been used in America and to a lesser extent in Europe for a collection of rather distinct elements linked together by the following characters:

Large robust forms, 8-15 mm. long; eyes densely haired; antennae large, the third segment truncate at the tip; second aristal segment somewhat elongate; palpi reduced in length, as long as the second antennal segment or reduced to mere papillae; epistoma strongly warped forward, the antennal and oral margin axes about the same length; bend of the fourth vein with a strong appendage, the apical cell open far before the wing tip; abdomen stout, bearing at least one pair of discal bristles on the intermediate segments.

The genera making up the *Linnaemya* group are closely allied to the genera of the *Ernestia* group and have much the same habitus. As in the *Ernestia* group, considerable confusion has arisen in trying to apply the various generic concepts and most of the lumping or splitting has had quite a negative result in arriving at the true relationship of the species.

In the groups of Tachinidae which larviposit or lay fully incubated eggs, as *Linnaemya* or *Ernestia*, we have been given additional means for adding information to our taxonomic system without a great deal of difficulty. By a simple dissection of the fertilized females, either fresh or long dead, fully formed first stage maggots can be obtained in great abundance. Again we may recover from the remains of the parasitized host, after the fly has emerged, the cast skins of the various stages of the maggot. Armed with the information provided from the various immature stages in addition to the information gained from the adults, we are in a much better position to make statements concerning the relationships of the species.

The works of Nielsen, Pantel, Thompson, Townsend and others contain much on immature stages, but rarely does one find an attempt to establish relationships or to correlate adult and maggot characters into workable form. Dr. W. R. Thompson, a great advocate of the taxonomy of immature stages, has repeatedly impressed on the writer the great benefits that such a correlation would bring, both in establishing the relationships of the different species and in giving a means for determining parasites which for one reason or another fail to emerge from the host. This summary, therefore, covering in particular the North American species of the *Linnaemya* group is an attempt to bring together the adult and first stage maggot of the different species into one taxonomic system. In so doing, many European species have been included so that the relationships of our forms may be more clearly shown.

I am especially indebted to Dr. W. R. Thompson for his generosity in loaning me many European specimens as well as for a great many other favours, and to Dr. H. J. Reinhard for loaning me the specimens from his collection.

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KEY TO ADULTS

1. Palpi reduced to papillae, at least not longer than the first antennal segment; postscutellar plates bare; species with much yellow hair on the pleura 2
   Palpi longer and cylindrical, not longer than the second antennal segment but usually half or more of that length; postscutellar plates bare or setose; species with black hair on the pleura 4
2. Parafacials nearly as wide as the clypeus, yellow haired on the upper third or more; male forceps fused into a single, narrow, triangular, beaked plate ..... *Bonnetia* RD 3
   Parafacials about half clypeal width and bare; male without orbital bristles; legs red; abdomen mostly red, with a comparatively narrow black vitta; male forceps as in *Bonnetia* (Europe) ..... *Linnaemya* RD ..... *vulpina* (F11.)
3. Male without orbital bristles; third antennal segment of the female over twice as long as the second, broad apically (Europe) ..... *Bonnetia sophia* (RD.)
   Male with orbital bristles; third antennal segment of the female less than twice as long as the second, comparatively little broadened apically (Europe, N. America) ..... *Bonnetia comta* (F11.)
4. Four sternopleurals and one post-acrostichal; outer vertical strong in both sexes; parafacials half clypeal width; cheek at least half eye height; proboscis long, the haustellum three-fourths head height in length; male forceps fused into a single narrow, triangular, beaked plate (N. America) ..... *Thompsonomyia* n. gen. ..... *anthracina* (Thom.)
   Three sternopleurals and three post-acrostichals; outer verticals usually absent in the male 5
5. R_5 bristled only at the base with four to six bristles 6
   R_5 bristled over half way to the crossvein 12
6. Inner vertical bristles strongly decussate in both sexes; intermediate abdominal segments with one pair of discals; parafacials less than half clypeal width; male forceps fused into a single flat, flask-shaped plate ..... *Bonellimyia* TT. 8
   Inner vertical bristles straight or at most the tips decussate; abdomen with many scattered discal pairs on the intermediate segments; parafacials half clypeal width; epistoma very prominent; male forceps as in *Bonellimyia* ..... *Nigrobonellia* n. gen. 7
7. Epistoma yellow, male genitalia red; male abdomen wholly black (N. America) ..... *Nigrobonellia nigrescens* (Cn.)
   Epistoma dark, male genitalia black; male abdomen reddish on the sides (N. America) ..... *Nigrobonellia varia* (Cn.)
8. Front yellowish or golden pollinose in both sexes; fourth abdominal segment of the female entirely reddish; length 8 mm. (Porto Rico) ..... *Bonellimyia fulvicauda* (Walt.)
   Front greyish or greyish yellow; fourth segment of female usually black basally 9
9. Humeri, lateral line of the mesonotum and the scutellum reddish in both sexes; sides of the abdomen broadly reddish in the male; the female abdomen wholly black, the red tip very narrow, less than the apical fourth of the fourth segment being red; ♂ forceps slightly knobbed at the tip 10
   Humeri, lateral line and abdomen dark, the abdomen at most with very faint red laterally 11
10. Pollen on the thorax and abdomen with a decided brown cast, the thoracic pollen at times quite golden; male forceps broad, the tip slightly turned

up and about even with the tip of the narrow triangular accessory processes (Europe) ..... *Bonellimyia haemorrhoidalis* (Fll.)

Pollen of thorax and abdomen grey; male forceps longer and narrower, the tip not turned up, projecting beyond the tip of the narrow triangular accessory processes (N. America) ..... *Bonellimyia tessellata* n. sp.

11. Pollen of thorax and abdomen heavy, grey; male forceps short and broad; not knobbed at the tip, the tip not projecting beyond the tip of the wide triangular accessory processes; red tip of the female abdomen rather extensive, one-third to two-thirds of the fourth segment being red apically (N. America) ..... *Bonellimyia glauca* n. sp.

Pollen of thorax and abdomen very thin, bluish grey; male forceps narrower, knobbed at the tip, the tip just projecting beyond the tip of the narrow triangular accessory processes; less than the apical third of the female fourth abdominal segment red (N. America) ..... *Bonellimyia subpolita* n. sp.

12. Discals weak or absent on abdominal segment two, outer vertical bristle present in the male; oral margin axis shorter than the antennal axis (S. America) ..... *Gymnochaetopsis analis* TT.

Discals strong on abdominal segment two; no outer vertical in the male; oral margin and antennal axes equal ..... *Homoeonychia* BB 13

13. Orbitals present in both sexes; male claws short; abdomen black (Europe) ..... *Homoeonychia lythosiophagus* (R.)

Orbitals absent in the male, claws long 14

14. Adbomen wholly black (Europe) ..... *Homoeonychia frater* (R.)

Abdomen reddish at the sides 15

15. Male genitalia reddish; female abdomen black (Europe) ..... *Homoeonychia impudicus* (R.)

Male genitalia black; female abdomen red tipped (Europe) ..... *Homoeonychia pudicus* (R.)

KEY TO FIRST STAGE MAGGOTS

1. Dorsal and pleural cuticular armor composed of dark, strongly chitinized plates overlapping as the scales of a fish; labial region of buccopharyngeal armature distinctly broader than the hypostomal region, with a distinct ventral angle; segment ten with a band of stout spines on the posterior border 2

Dorsal and pleural armor composed of plates which do not overlap; labial region little enlarged, without a distinct ventral angle; segment ten without a band of very stout spines on the posterior border 9

2. Some of the dorsal and pleural plates, particularly those on the anterior segments, having a series of teeth on their posterior borders; without a pair of stout oral hooks; hypostomal region with a thin, dorsal, expanded region which is feebly or strongly fenestrate 3

Dorsal and pleural plates not pectinate, the anterior plates pointed or at most with two or three stout spines; a pair of stout oral hooks present; expansion of hypostomal region generally small, not fenestrate 5

3. Dorsal expansion of hypostomal region small, feebly fenestrate with one or two clear spaces; hypostomal region twice as long as the labial region ..... *Linnaemya vulpina* (Fll.) *

Dorsal expansion of hypostomal region very large, strongly fenestrate with many clear areas, the anterior part of the infrahypostomal sclerite also fenestrate 4

4. Hypostomal region of buccopharyngeal armature twice as long as the anterior expanded region ..... *Bonnetia comta* (Fll.) *

Hypostomal region not as long as the anterior expanded region ..... *Bonnetia sophia* (RD.) *

*Described and illustrated by W. R. Thompson, Ann. des Epiphytes, IX, 157-163 (1923).

5. Pleural plates nearly round, not twice as long as broad, compactly placed and overlapping much as the dorsal plates (fig. 7), not carinate; ventral armature composed mostly of rounded plates, many of which are overlapping ..... *Nigrobonellia varia* (Cn.)
Pleural plates elongate, oval, twice or more as long as broad, generally rather loosely placed and overlapping only at their tips (fig. 11), with a darker carina; ventral armature mostly of simple spines and a few rounded plates, at least on the anterior segments 6
6. Labial region very broad, with a pronounced dorsal curvature and ventral angle, the anterior edge serrate on the dorsal half (fig. 4) ..... *Bonellimyia glauca* n. sp.
Labial region moderately expanded, the anterior edge smooth 7
7. Eleventh segment with a band of small spined plates only; dorsal expansion of hypostomal region small (fig. 3) ..... *Bonellimyia tessellata* n. sp.
Eleventh segment with a small patch of spined plates on the pleural region in addition to the complete band 8
8. Labial region large, three-fourths as broad as long; dorsal expansion of hypostomal region large, triangular (fig. 2) *Bonellimyia subpolita* n. sp.
Labial region little expanded, about half as broad as long; dorsal expansion of the hypostomal region very small *Bonellimyia haemorrhoidalis* (Fll.) *
9. Dorsal and pleural armature composed of small rounded plates, well separated from each other; the maggot large, nearly clear (fig. 5) ..... *Thompsonomyia anthracina* (Thom.)
Dorsal and pleural armature composed of large, irregular, well chitinized plates 10
10. Labial region distinctly enlarged, only a little longer than the hypostomal region ..... *Homoeonychia lythiosophaga* (R.) *
Labial region not enlarged, twice as long as the hypostomal region ..... *Homoeonychia frater* (R.) *

The following North American species were not definitely placed:

Tachina (*Cuphocera*) *speculifera* Walker — List, 4, 731 (1849), N. A. Austen (Ann. Mag. N. Hist. 19, 7, 335, 1907) has indicated that this species is related to *haemorrhoidalis*. Walker's description fits the species *Bonellimyia tessellata* n. sp. better than any other but there are certain discrepancies which make it advisable to leave the name for the present.

Micropalpus nigrifrons Bigot — Ann. Soc. Ent. Fr., 263, (1888), Mex. The description indicates a species of *Bonellimyia* allied to *fulvicauda* Walton. It may however belong to the genus *Gymnochaetopsis* Townsend.

Micropalpus angustifrons Wulp — Tijschr. v. Ent., 35, 193 (1892); Biol. C. A. Dipt., 2, 474 (1903) Mexico. What has been said about *nigrifrons* Big. may also be said for this species.

Genus **Linnaemya** R. Desvoidy

1830—*Linnaemya* R. Desvoidy, Myodaires, 52; seven species including *L. silvestris* RD. (1830) which equals *Tachina vulpina* Fallen (1810); genotype designated by Desvoidy (1863) as *silvestris*.

The structure of the head, wing and genitalia of this genus as well as the color and pilosity indicate that *Linnaemya* is more closely allied to *Bonnetia* than to the other segregates of *Linnaemya* sens. lat. The structure of the first stage maggot also substantiates this relationship (Thompson, 1923).

No North American species so far described belongs to the genus *Linnaemya* RD. in the restricted sense.

Genus **Bonnetia** R. Desvoidy

1830—*Bonnetia* R. Desvoidy, Myodaires, 55; two species including *B. oenanthis* RD. (1830) which equals *Tachina comta* Fallen (1810); genotype designated by Townsend (1916) as *oenanthis*.

*Described and illustrated by W. R. Thompson, Ann. des Epiphytes, IX, 157-163 (1923).

1830—*Marshamia* R. Desvoidy, Myodaires, 57; two species including *M. analis* RD. (1830) which equals *Tachina comta* Fallen (1810); genotype designated by Townsend (1916) as *analis*.
1834—*Micropalpus* Macquart, Dipt. Nord., 5, 316; six species including *Bonnetia oenanthis* RD. (1830) which equals *Tachina comta* Fallen (1810); genotype designated by Townsend (1916) as *oenanthis*.

Townsend in his *Manual of Myiology* has separated *Bonnetia* RD. (*Micropalpus* Macq.) from *Marshamia* RD., placing the former in the tribe Linnaemyiini, the latter in the tribe Cuphocerini, further stating that *Bonnetia* is European and *Marshamia* American. His descriptions of the two are similar and an examination of species from both regions failed to bring to light any characters on which the genotype species could be separated, nor could characters be found in the first stage maggots which might be of use. For this reason it is concluded here that the species *comta* Fall. occurs in both regions and was redescribed as *Marshamia analis* by Desvoidy.

Bonnetia comta (Fallen)

Tachina comta Fallen, Vet. Akad. Handl., 31, 284 (1810), Europe. Bezzi and Stein, Kat. palaark. Dipt., 3, 203 (1907), *Linnaemyia*, synonymy; Coquillett, Rev. Tach., 87 (1897), *Linnaemyia;* Thompson, Can. Ent., 43, 265 (1911), Ann. des Epiphytes, 3, 157, (1923), *Linnaemyia*, maggot; Strickland, Can. Ent., 53, 97 (1921), Can. Dept. Agric. Ent. Bull., 22, 29 (1923), *Bonnetia*, life history; Curran, Ent. News, 36, 13 (1925), *Bonnetia;* Townsend, Manual of Myiology, 8, 221 (1939), *Bonnetia*.
Linnaemyia distincta R. Desvoidy, Myodaires, 54 (1830), Philadelphia. Bauer, Sitz. Akad. Wien, 107, 496 (1898), *Micropalpus*.
Marshamia analis R. Desvoidy, Myodaires, 58 (1830), Carolina. Townsend, Manual of Myiology, 8, 198 (1939), *Marshamia*.
Marshamia nigripes R. Desvoidy, Myodaires, 58 (1830), Carolina.
Micropalpus piceus Macquart, Suit a Buff., 2, 84 (1835), change of name for *Marshamia analis RD*.

Only the synonymy of the species described from North America is repeated above.

This species is sufficiently well known in both adult and immature stages so that no additional description is needed. In North America and Mexico *comta* has a wide distribution and is at times an effective parasite of various cutworms. One specimen in the Canadian National Collection was reared from the white grub, *Phyllophaga* sp. The species is rather variable in size and color, particularly the color of the legs and abdomen; these parts along with the humeri and lateral line of the mesonotum are generally reddish but may also be black; the color of the pollen is also variable, being greyish-yellow to grey. In Canada two populations appear evident, western specimens from British Columbia, Alberta and Saskatchewan are on the whole larger, more reddish and with yellowish grey pollen, while eastern representatives from Ontario and Quebec are smaller, darker in color and with greyish pollen which at times is quite thin, almost subshining on the mesonotum. European specimens that I have seen (Germany), agree better with our eastern than with our western specimens.

The European species *sophia* RD. is closely related as was pointed out by Thompson in his work on the immature stages (1923).

Genus **Bonellimyia** Townsend

1830—*Bonellia* R. Desvoidy, preoc., Myodaires, 56; three species including *B. tessellans* RD. (1830) which equals *Tachina haemorrhoidalis* Fallen (1810); genotype designed by Townsend (1916) as *tessellans* RD.
1919—*Bonellimyia* Townsend, Ins. Ins. Mens., 4, 177, change of name for *Bonellia* RD.; genotype *Tachina haemorrhoidalis* Fallen.

The genotype species has been reported from North America by Coquillett under the name *Linnaemyia picta* Meigen and by Thompson, Can. Ent., 43, 265 (1911) and Curran, Ent. News, 36, 14 (1925) as *Linnaemyia haemorrhoidalis* Fall. These records do not refer to the true *haemorrhoidalis*, but to the three congeneric American species described below.

While the species are somewhat difficult to separate from one another, the structure of the first stage maggots indicates that the genus may be divided into two groups; one group includes *haemorrhoidalis* Fall., *tessellata* n. sp. and *subpolita* n. sp.; *glauca* n. sp. and possibly *fulvicauda* Walt. forming the second. This grouping is also borne out by the structure of the male genitalia and the color of the female. The European species *frater* Rondani, *impudicus* Rondani and *pudicus* Rondani, usually placed in the same segregate as *haemorrhoidalis,* do not belong to *Bonellimyia* but are species of the genus *Homoeonychia.*

Bonellimyia tessellata n. sp.

Of our American forms this species is the most easily confused with the European species. *B. haemorrhoidalis* however tends to be larger, the pollen of the thorax and abdomen having a decided brown cast, and the male genitalia are somewhat shorter and broader.

Male. Length 11-13 mm. Antennae black, the second segment red tipped, third segment four-fifths as broad as long, rounded truncate at the tip, nearly straight on the upper and lower edges beyond the insertion of the arista; palpi dark brown, as long as the second antennal segment; frontal vitta dark brown, equibroad; parafrontals dark grey, clypeus, parafacials and cheeks silvery grey with a slight brownish tinge, occiput silvery grey with a white ruff; vertex just over one-fourth head width, the front widened to two-fifths head width at the antennae.

Mesonotum mostly black, thinly greyish pollinose, showing four dark vittae in front of the suture, three behind; humeri, lateral line and postcallus reddish, scutellum reddish, dark only at the base. Legs black, tibae dark brown, elongate pulvilli yellowish. Wings clear, veins brown, R_5 bristled only at the base with four or five bristles; squamae white; halteres yellow.

Abdomen mostly black, broadly reddish on the sides of the intermediate segments and with a very narrow red tip, greyish pollen with changing reflections, mostly confined to the anterior half of the segments; one pair of discals on the intermediate segments. Genital segments reddish, the forceps and accessory processes black; forceps long and comparatively narrow, slightly enlarged at the tip, the tip projecting beyond the tip of the narrow triangular accessory processes.

Female. The female is generally very similar to the male; third antennal segment narrower, about half as wide as long, broader at the apex than at the insertion of the arista; two proclinate orbitals present; abdomen wholly black, the fourth segment with a very narrow red tip, black on the basal two-thirds or more; genital segments reddish or brown.

A considerable amount of variation occurs in the color of the males; some specimens have the thorax and abdomen mostly black, and all gradations between the typical and the black form occur. Mostly black males may be distinguished from *glauca* n. sp. by the shape of the genitalia and from *subpolita* by the larger size, more heavily pollinose thorax and abdomen and by the grey cheek. The females are remarkably constant in color.

First stage maggot—The first stage maggot of *tessellata* is quite similar to that of *haemorrhoidalis;* the dorsal, pleural and ventral regions are not as clearly marked; the pleural plates are less elongate and closer together, showing a much fainter carina; the labial region is narrower, and the eleventh abdominal segment has no group of spines on the pleura.

Length 0.68 mm., width 0.14 mm., length of buccopharyngeal armature 0.106 mm. Head bare except right behind the mouth where there is a large group of hooked spines. Segment I dorsally and pleurally covered with strongly pigmented overlapping plates, rather irregular in outline, some with a distinct tooth on the posterior margin. Segment II dorsally and pleurally covered with

triangular plates, each plate with a distinct spine on the posterior margin, the dorsal plates having a very wide base, much wider than long, the pleural plates narrower, nearly round or slightly oblong; ventral plates similar to but smaller than the pleural plates. Segment III dorsally on the anterior fourth with small triangular toothed plates similar to those on segment two, the posterior three-fourths with broad, oblong or rectangular, strongly overlapping plates, the plates wider than long; pleurally the anterior part of the segment with spined triangular plates, the posterior two-thirds covered with elongate, rectangular or oval plates each of which is more or less carinate and only slightly overlapping the next (fig. 11). Segments IV-X are very similar, dorsally covered with transverse, overlapping plates, none of which show teeth; pleurally with narrow longitudinal plates, the ends of which overlap; ventrally the armature is divided into three bands, the anterior narrow band (three or four rows) of small hooked spines narrowly separated by a clear area from the second band which is composed of narrow spined plates as the pleura of segment two, this band being incompletely separated from and grading into the third band which is composed of rounded or triangular non-toothed plates; this gradation is more complete on the posterior segments; in addition to these three bands, segments 6, 7, 8, 9 have an additional band of stout spines generally in one row along the posterior margin of the segment. The posterior border of segment X is completely circled by a row of very stout, short teeth. Segment XI shows a complete band of spined plates with the spines pointing forward, encircling the segment posteriorly. Felt chambers narrow, not enlarged posteriorly, eight times as long as wide.

Pharyngeal sclerite narrow, foot-shaped, as long as the infrapharyngeal; infrapharyngeal somewhat narrowed posteriorly, weakly chitinized; hypostomal region narrow, dorsal border with a small, weakly chitinized expansion, this expansion less than half as wide as the hypostomum, hypostomal region longer than the labial region; labial region somewhat expanded, leaf-like, the anterior edge smooth, three-fifths as wide as long, slightly over half as wide as the length of the oral hooks; oral hooks very strong, separated from the dentate which is smaller and less strongly chitinized (fig. 3).

Holotype—♂, Petite Riviere, N. S., 18.VII.1935 (J. McDunnough); No. 5397 in the Canadian National Collection, Ottawa.

Allotype—♀, Aylmer, Que., 28.IX.1924 (C. H. Curran).

Paratypes—2 ♂, Petite Riviere, N. S., 18.VII.1935 (J. McDunnough); 2 ♂, Slave Lake, Alta., July 21, 1924 and Aug. 25, 1924; 4 ♂, Greys Mills, N. B., 17.VIII.1913 and 18.VIII.1913 (R. P. G.); 1 ♂, Hunts G., N. S., July 18, 1931 (C. E. Atwood); 5 ♂, Low Bush, Lake Abitibi, Ont., 16.VIII.25, 25.VII.25. 9.VIII.25, 16.VIII.25, 20.VII.25 (N. K. Bigelow); 2 ♂, Laniel, Que., July 13, 1931 and Aug. 1, 1935 (H. S. Fleming); 3 ♂, St. Stephens, N. B., 25.VII.1913 (A. B. Baird); 2 ♂, Edmonton, Alta., June 3, 1923, July 1, 1923 (E. H. Strickland); 1 ♂, Elk Lake, Alta., Aug. 12, 1923 (E. H. Strickland); 1 ♂, Waterton Lakes, Alta., 27.VI.1929 (J. H. Pepper); 1 ♂, 100 Mile House, B. C., 4.VII.1938 (G. S. Walley); 1 ♂, Trinity Valley, B. C., July 27, 1938 (K. Graham); 3 ♀, Low Bush, Lake Abitibi, Ont., 13.VIII.25, 5.VIII.25, 27.VII.25 (N. Bigelow); 2 ♀, Laniel, Que., Aug. 4, 1931 (H. S. Fleming); 2 ♀, Slave Lake, Alta., Aug. 29, 1924; 1 ♀, Slave Lake, Alta., Aug. 29, 1924; 1 ♀, Waskesiu, Sask., Aug. 31, 1928 (E. McMillan); 1 ♀, Spruce Grove, Sask., July 24, 1921 (T. N. Willing); 1 ♀, Elk L., Alta., Aug. 12, 1923, (E. H. Strickland); 3 ♀, Fredericton, N. B., 6.VIII.1913 (J. D. Tothill); 1 ♀, Kentville, N. S., Oct. 8, 1915; 1 ♀, N. Andover, Mass., 16.VII.11 (J. D. Tothill); 1 ♀, Musquash, Ont., 11.IX.12; 1 ♀, Millerville, Alta., (Dodd); 1 ♀, Lethbridge, Alta., July 23, 1913 (E. H. Strickland) in the Canadian National Collection, Ottawa; 4 ♂ nr. W. Rupert, Vt., VII.14.1940 (Blanton and Borders); 1 ♂, Cameron Pass, Colo., 21.VIII.1940 (R. K. Fletcher); 1 ♂, Idaho, Sept. 1; 1 ♂, Cle Elum Wn.,

10.VI.1933 reared from *Agrotis smithii*; 1 ♂, Franconia, N. H., 7.VII.15 (C. H. T. Townsend); 1 ♂, Mt. Equinox, Vt., 15.VII.1935 (Blanton and Borders); 1 ♀, Smoky Mts., Tenn., June 19, 1932 in Dr. Reinhard's collection.

Bonellimyia glauca n. sp.

Male. Length 11 mm. Antennae black, palpi dark brown; vertex about one-fourth head width, front widening to four-elevenths head width at the antennae; front dark grey, parafacials and clypeus greyish, with a strong golden tinge which is in quite sharp contrast to the whitish pollinose cheeks; occiput silvery with a white ruff. Thorax black, thinly greyish pollinose, four distinct vittae before the suture, three behind; humeri, lateral line and most of scutellum black. Abdomen wholly black or with a faint suggestion of red laterally, obscurely red tipped, wholly heavily greyish pollinose. Genital forceps comparatively short and broad, the tip not enlarged, the tip about even with the tip of the wide triangular accessory processes. Otherwise as in *tessellata*.

Female. Very similar to the male, humeri and lateral line black or slightly reddish behind; abdomen black, fourth segment reddish on the apical half or more, basally black.

First Stage Maggot—Length 0.54 mm., width 0.125 mm. This maggot is very similar to that of *tessellata* n. sp. so that only the differences are noted here. 1. Segment XI has a patch of setae on each side in addition to the complete band. 2. Ventrally the armature is quite in contrast to that of *tessellata* and *subpolita*; three definite bands are present, the anterior band of stout hooked plates in 1 or 2 rows, very distinctly separated from the second band which is made up of very narrow spined plates arranged in one row; this in turn is separated by half the width of the segment from the posterior band of small hooked plates which is in one or two rows; triangular or rounded plates as found on the other species are wholly lacking. 3. Dorsally and pleurally on the posterior border of segments VIII and IX there are two or three rows of very small rounded spined plates, the spines pointing anteriorly, this band being a continuation of the posterior ventral band. 4. The labial region of the buccopharyngeal armature is very distinctive in this species, separating it at once from the other three; labial region very broad, with a distinct dorsal curvature and large rounded ventral angle, four-fifths as long as broad, two-thirds as long as the narrow hypostomal region; anterior edge serrate on the dorsal half (fig. 4); dorsal expansion of hypostomal region small; infrapharyngeal sclerite narrow, parallel-sided, slightly longer than the narrow footlike pharyngeal sclerite.

Holotype—♂, Covey Hill, Que., 29.VI.1927 (W. J. Brown); No. 5398 in the Canadian National Collection, Ottawa.

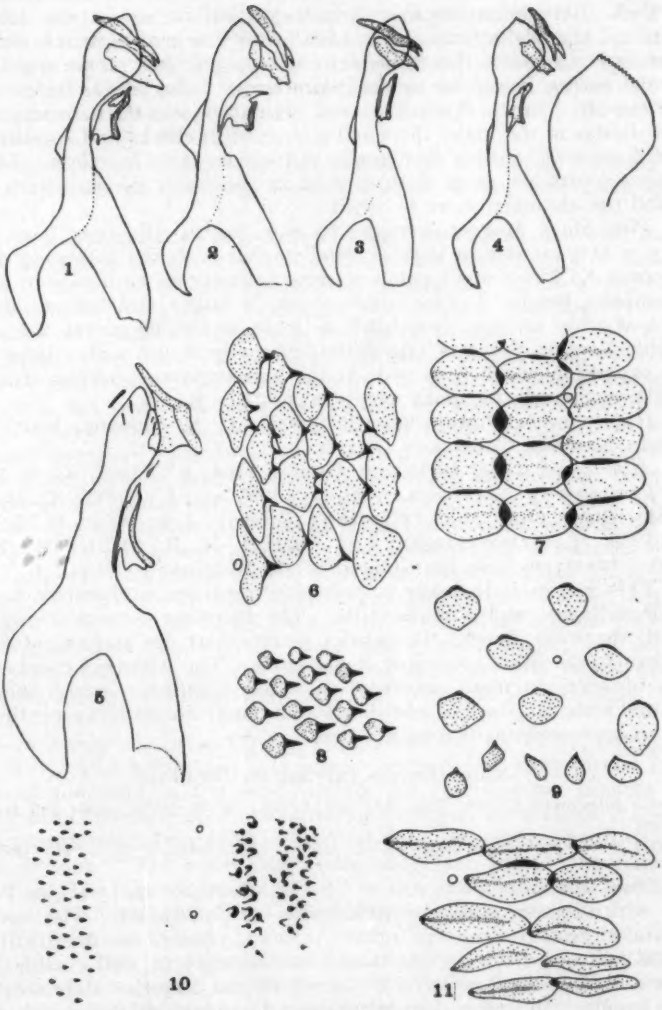
Allotype—♀, Lyn, Ont., 10.VIII.1926 (F. P. Ide).

Paratypes—1 ♂, Likely, B. C., 1.VII.1938 (J. K. Jacob); 1 ♂, Putnam, Ont., 26.VI.1925 (G. S. Walley); 1 ♂, nr. Salem, Mass., 9.VII.11 (J. D. Tothill); 1 ♂, Stamford, Conn., July 5, 1920; 1 ♀, Trinity Valley, B. C., July 15, 1938 (K. Graham); 1 ♀, White Pt. Beach, N. S., 10.VIII.1935 (J. McDunnough); 1 ♀, Fredericton, N. B., 12.VIII.1915 (A. B. Baird); 1 ♀, Truro, N. S., Sept. 26, 1913; 2 ♀, Musquash, Ont., 11.IX.12 in the Canadian National Collection, Ottawa; 1 ♂, Clarenceville, P. Q., 20.VI.1931 (G. Hammond); 1 ♂, Colo., 7.10.27; 1 ♂, Hanover, N. H., (C. H. Weed); 1 ♂, Agr. Coll., Mich., July 15, 1922 (L. G. Gentner); 1 ♀, Amherst, Ohio, July, 1933 (H. J. Reinhard) in Dr. Reinhard's Collection.

Bonellimyia subpolita n. sp.

This species is very closely allied to *tessellata* n. sp., the shape of the male forceps and the color of the female abdomen being very similar in the two species.

PLATE XII.



SPECIES OF *LINNAEMYA* SENS. LAT.

Male. Length 9 mm. Antennae and palpi black; vertex just over one-fourth head width, the front widening to two-fifths head width at the antennae; front dark grey, clypeus and parafacials yellowish grey, the pollen rather thin, cheeks yellowish, the cheek pollen practically absent, occiput dark with thin silvery pollen. Mesonotum subshining black, the bluish grey pollen very thin, vittae indistinct except in front; humeri, lateral line and most of scutellum black. Abdomen black with a suggestion of red at the sides and an obscure red tip; abdominal pollen bluish grey and comparatively thin. Genital forceps rather slender, the tip somewhat enlarged, just projecting beyond the tip of the narrow triangular accessory processes. Otherwise as in *tessellata* n. sp.

Female. Except for sexual and secondary sexual characters the female is very similar to the male; the small size, reddish cheeks and subshining bluish grey abdomen will readily distinguish this species from *tessellata.* The thoracic vittae are somewhat more distinct than in the male, the scutellum more reddish and the abdomen more polished.

First Stage Maggot—Length .76 mm., width .16 mm.; the first stage maggot is very similar to that of *tessellata* but with the following differences: 1. Segment XI has a small patch of setae laterally on each side in addition to the complete band. 2. The labial region is larger and longer, about three-fourths as wide as long, two-thirds as wide as the length of the oral hook; hypostomal region about as long as the labial region and with a large triangular dorsal expansion which is as wide as the hypostomum; pharyngeal sclerite and infrapharyngeal sclerite more widely separated (fig. 2).

Holotype—♂, Ottawa, Ont., 2.VI.1927 (C. H. Curran); No. 5399 in the Canadian National Collection, Ottawa.

Allotype—♀, Mer Bleue, nr. Ottawa, Ont., 8.VI.1927 (G. S. Walley).

Paratypes—4 ♂, Ottawa, Ont., 2.VI.1927 and 8.VI.1927 (C. H. Curran); 1 ♂, Mer Bleue, Ont., 28.VI.1927 (W. J. Brown); 1 ♀, White Pt. Beach, N. S., 23.VII.1939 (J. McDunnough); 1 ♀, Barber, N. B., 23.VI.1924 (F. M. McKenzie). Paratypes have been placed in Dr. Reinhard's collection.

This species is in many respects intermediate in character between the genus *Bonellimyia* and *Nigrobonellia.* The epistoma is more strongly warped forward, the front flatter, the bristles weaker and the abdominal hairs more erect than in the other species of *Bonellimyia.* The narrower cheeks and parafacials, broader antennae, strongly decussate verticals, strong thoracic and abdominal setae and lack of additional abdominal discals however, link it more closely to *haemorrhoidalis* than to *varia.*

Bonellimyia fulvicauda (Walton)

Linnaemyia fulvicauda Walton, Proc. Ent. Soc. Wash., 16, 93 (1914); male and female, Porto Rico.

Linnaemyia compacta Curran, Dept. Agric. Jamaica, Ent. Bull., 4, pt. 1, 113 (1926); female, Jamaica.

Under the name *L. compacta* Cn., Dr. Reinhard sent me one Porto Rico female which agrees with the description of *fulvicauda.* The species may be separated readily from the other American species on the small compact form, the yellowish front, lighter third antennal segment, dull greyish or whitish thoracic and abdominal pollen and the wholly red posterior abdominal segment in the female. In color this form strongly resembles the South American *Gymnochaetopsis analis* TT.

Genus **Nigrobonellia** n. gen.

Genotype—Linnaemyia varia Curran, Ent. News, 36, 14 (1925); holotype male, allotype female, Hopedale, Labr., in the Canadian National Collection, Ottawa.

This genus is quite closely allied to *Bonellimyia* but differs from that genus as follows.

Front very broad (over one-third head width) and flat; epistoma very

strongly projecting, the oral margin axis longer than the antennal axis; haustellum over half head height in length; parafacials slightly narrowed below, half clypeal width at the centre; cheek half eye height; inner vertical bristles straight, convergent or with the tips decussate but not strongly decussate. Thoracic setae weak, especially in the male; acrostichals 1.3, the anterior two behind the suture hairlike, in the female acrostichals 3.3; dorsocentrals likewise weak; anterior presutural supraalar absent; scutellum with four lateral scutellars and a strong apical pair which are decussate at the tips; postscutellar plates sparsely setose to nearly bare. Intermediate abdominal segments with several scattered discal pairs in the male, one or two pairs in the female; the fourth segment with two or three scattered discal rows. Genitalia as in *Bonellimyia*.

Linnaemyia varia Cn. is represented in the Canadian National Collection by a number of specimens from Hopedale, Labr., and Lake Harbour, Baffin Land.

First Stage Maggot of varia-Length 0.86 mm., width 0.20 mm.: very dark. The first stage maggot of *varia* is very similar to the first stage maggot of *Bonellimyia tessellata*. The dorsal, pleural and ventral regions are not as strongly marked as in *tessellata* as the pleural plates are not elongate but slightly oval, not twice as long as broad, overlapping as the dorsal plates (fig. 7) and without a distinct carina, sometimes with a faintly darkened central area. Ventrally on segments IV and V three bands are present, the posterior one of round chitinized plates is not separated from the second; on segments VI to X the first band is of spined plates, the second and third bands are united to form one broad band composed entirely of many round plates, some of which overlap as do the pleural plates, and in addition there is a fourth band composed of spined plates, the spines pointing forward; on segment XI there are spined patches on the dorsolateral, dorsoventral and middorsal surfaces as well as the complete band being present. Buccopharyngeal armature very like *tessellata* (fig. 1); pharyngeal sclerite with a pronounced dorsal angle, rounded at the tip, about even with the tip of the infrapharyngeal sclerite, hypostomal region stout, rodlike, the dorsal expansion small, labial region distinctly expanded with a pronounced dorsal curve and ventral angle, four-seventh as broad as long, two-thirds as wide as the length of the oral hooks, oral hooks strongly chitinized, tooth-like, well separated from the less strongly chitinized dentate.

Linnaemyia nigrescens Curran (Ent. News, 36, 15, 1925), holotype male, Hedley, B. C., also belongs in this genus. Superficially this species resembles *Bonellimyia subpolita* to a marked degree; the antennae are broader than in *varia*, the front narrower, the macrochaetae stronger, acrostichals 3.3, although only one presutural and the hind postsutural are strong and a fine front supraalar bristle is present. The wider parafacials, cheek and front, longer inner verticals with only the tips decussate as well as the more projecting epistoma and presence of additional abdominal discals however show that the true relationship of this species is to *varia*.

Female. One specimen from Cormorant Lake, Man., 20.VII.1927 (J. Russell) fits with *nigrescens* on the characters given in the key. The shining blue black abdomen has but one stout pair of discals on the intermediate segments. Unfortunately this female contained no maggots.

Genus **Homoeonychia** Brauer and Bergenstamm

1863—*Amphisa* R. Desvoidy, preoc. Hist. Dipt., 1, 129; one species as *A. laticornis* RD. (1863) which equals *Micropalpus lythosiophagus* Rondani (1859).

1889—*Homoeonychia* Brauer and Bergenstamm, Musc. Schiz. 1, 65; one species as *Micropalpus lythosiophagus* Rondani (1859).

This genus as *Bonnetia* was founded on a species in which the male pos-

sessed many female characters, such as a broad front, orbitals, and short claws and pulvilli. The other species in the genus lack these characters in the male and so have largely been placed elsewhere, chiefly in *Bonellimyia*. The three European species *Micropalpus frater* Rondani, *impudicus* Rondani, and *pudicus* Rondani belong here. As these species lack orbital bristles in the male they show a remarkable resemblance to species of *Bonellimyia* in all characters except the bristling of R_5, the slightly shorter appendage at the bend of the fourth vein, the structure of the male genitalia and in the characters of the immature stages. In *Bonellimyia* species the male forceps are united into one large, flat, flask-shaped plate, while in *Homoeonychia* species the forceps are slender, fused and deeply grooved middorsally. Thompson (1923) has pointed out the close similarity between the first stage maggots of *lythiosophagus* and *frater*.

No species of *Homoeonychia* is known to occur in North America.

Genus **Thompsonomyia** n. gen.

Genotype—Linnaemyia anthracina Thompson, Can. Ent., 43, 266 (1911); holotype female, Hymers, Ont., in Washington, allotype male in Ottawa.

Length 9 mm. Black with red-tipped scutellum. Head but little wider than high; frontal profile flat, as long as the facial; raised clypeus longer than wide; epistoma strongly warped, slightly narrower than the clypeus, half as long as the same; oral margin axis longer than the antennal axis; proboscis one and one-third times as long as the head height, the haustellum three-fourths head height in length and slender; palpi slender, cylindrical, half as long as the second antennal segment; antennae not reaching the vibrissae, the third segment truncate at the tip, one-fourth longer than the second segment; arista bare, second segment elongate; female vertex just over one-third head width, the male one-fourth; frontalia two-thirds frontal width; ocellar bristles weak, proclinate; outer verticals strong in both sexes, inner verticals decussate; no orbitals in the male, one proclinate and two outwardly directed orbitals in the female; parafacials half clypeal width; cheek half eye height.

Acrostichals 2.1, the anterior presutural hair-like; dorsocentrals 3.3, intraalars 1.3, supraalars 1.3 lateral scutellars 4, apical scutellars strong, decussate; pteropleural nearly as long as the sternopleurals; four sternopleurals; lateral plates of postscutellum and prosternum bare. Wings clear, 5R narrowly open far before the wing tip; long stump present at the cubitulus; last section of cubitus one-third the length of the preceding; two costal spines nearly as long as R_6; R_5 bristled at the base. Female front tarsus very wide.

Abdomen pointed; first segment without bristles, intermediate segments with two pairs of discals, fourth segment with two discal rows; lateral bristles numerous and scattered. Larvipositor small, tergites six and seven reduced; male forceps small, united, triangular when viewed from above.

Linnaemyia anthracina is represented in the Canadian National Collection by the male allotype, Hymers, Ont., and by one female, Lake Harbour, Baffin Land, from which the above description was drawn. This one female contained twenty-seven large maggots arranged in pairs in the uterus; the uterus was rather short in comparison to those of other *Linnaemya*, consisting of but two coils instead of the usual four or five. The condition of the uterus may have been normal or due to partial oviposition having taken place.

First Stage Maggot—Length 0.98 mm., width 0.34 mm., length of buccopharyngeal apparatus 0.17 mm., larva large, robust, nearly clear.

The cuticular armature is quite different than in the other members of *Linnaemya* sens. lat. The larva is practically colorless, as the small round plates making up the armature are well separated from each other and are nowhere numerous; the plates furthermore are only moderately chitinized. The elements composing the dorsal and pleural armature are of one type only, that is small round, oval or oblong plates, feebly colored, somewhat pointed and more heavily

chitinized on their posterior margins; only slight modifications of this one form are found.

Head bare, ventrally presenting a small patch of minute plates around the mouth. Segment I bare except for a small patch of about a dozen small plates (similar to those on the head) situated dorsolaterally. Segment II, dorsally, the plates are all well separated, those on the anterior part of the segment small and narrowed, the posterior spine very distinct (fig. 8), the posterior border has more or less triangular plates, the apical spine of which is represented by a more thickly chitinized area (fig. 9); the pleural region is only partly separated from the dorsal region, the rows of plates being continuous on the anterior border of the segment but broken on the posterior two-thirds, these pleural plates are nearly round, very strongly spined behind; the ventral region is only narrowly separated from the pleural region and is composed of similary although smaller plates occurring in a broad band on the anterior half of the segment. Segment III is similar to segment II. Segments IV, V, VI, and V11 are very similar to each other, divided into three rather distinct regions, the dorsal region taking up the dorsal third of the body, the pleural region along the mid lateral line and rather narrow and distinctly separated from the dorsal region except in front, and the ventral region on the ventral fourth, widely separated from the pleural region; dorsally and pleurally the armature is composed of rounded, thinly chitinized plates, similar to those found on the posterior half of segments II and III, the small distinctly spined elements lacking; ventrally the armature is divided into three distinct bands (fig. 10), the anterior band along the anterior margin of the segment, three or four rows deep, of very small rounded or oblong plates most of which show a distinct spine behind, the central band widely separated from the first, composed of one or two rows of irregular hooked plates, the hindmost band along the posterior margin only narrowly separated from the central band, composed of three to five rows of elements similar to those of the first row. Segments VIII, IX and X are very like the preceding segments but the dorsal and pleural plates are progressively smaller; the posterior ventral row of each segment is continued upwards to form a complete band around the body, the very small thorn-like plates having the spine pointing anteriorly. Segment XI clear, with one broad band of spined elements in about fifteen rows encircling the segment, the spines of these elements pointing towards the anterior. Felt chambers enlarged apically, six times as long as broad.

Buccopharyngeal armature large and robust (fig. 5); pharnygeal sclerite very broad, pointed behind; infrapharyngeal narrower than the pharyngeal, parallel sided; hypostomal region very thick, three times as long as broad, showing a decided dorsal hump but no dorsal expansion; labial region but little expanded, without a distinct ventral angle, the anterior edge smooth, slightly emarginate near the centre; oral hooks not separated from the dentate, weakly chitinized; infrahypostomal sclerite large. There is also present a rod-like sclerite above the labial region and a smaller one below it in front of the infrahypostomal sclerite.

Antennae twice as long as broad, broadly rounded at the tip; dorsal sensory formula 2.3.3.2, the sensory pores conspicuous.

EXPLANATION OF PLATE XII.

Fig. 1 Buccopharyngeal armature of *Nigrobonellia varia* (Cn.): first stage maggot removed from uterus.

2 Buccopharyngeal armature of *Bonellimyia subpolita* n. sp.: first stage maggot removed from uterus.

3 Buccopharyngeal armature of *Bonellimyia tessellata* n. sp.: first stage maggot removed from uterus.

4 Buccopharyngeal armature of *Bonellimyia glauca* n. sp.: first stage maggot removed from uterus.

5 Buccopharyngeal armature of *Thompsonomyia anthracina* (Thom.): first stage maggot removed from uterus.
6 Dorsal cuticular armature of *Nigrobonellia varia*, segment two.
7 Pleural cuticular armature of *Nigrobonellia varia*, segment three.
8 Dorsal cuticular armature of *Thompsonomyia anthracina*, segment two. The pleural plates are similar.
9 Dorsal cuticular armature of *Thompsonomyia anthracina*, segments three to ten.
10 Ventral cuticular armature of *Thompsonomyia anthracina*, segment four.
11 Pleural cuticular armature of *Bonellimyia tessellata*, segment three.

HYDRIOMENA STUDIES II*

THE *RUBERATA* GROUP

BY J. McDUNNOUGH,

Ottawa, Ont.

In a previous paper I discussed the character of the female genitalia of the genus *Hydriomena* in general and more particularly in connection with the *glaucata-crokeri* group. In the present paper I offer further notes on certain other species of the genus which I have lumped roughly into the *ruberata* group. All these species show in the male genitalia a deep excavation between the forks of the uncus; each fork tends to broaden toward its apex which is evenly rounded and not bent downward nor pointed.

Hydriomena ruberata Frey.

This European species, the female genitalia of which are very inadequately figured by Pierce in his Genitalia of the British Geometridae, has long been recognized as occurring in North America over a wide-spread territory. It was discussed and adults and male genitalia figured in my 1917 revision; its long, thin, slightly downcurved palpi are one of its distinguishing features.

The male genitalia of North American specimens differ very slightly in certain minor characters from those of British specimens but not sufficiently, to my mind, to warrant a racial name. The chief difference occurs in the two thin, curved, chitinous rods arising from the basal costal papillae; these, in North American specimens are both rather thick and subequal, whereas in European ones the outer one is hardly thicker than the adjacent knobbed hairs; the narrow excavation between the uncus lobes is mostly somewhat shorter in American specimens, leaving a longer and thinner neck, but this feature shows a certain amount of variability.

In the female genitalia I can find no differences between American and European specimens. The ductus bursae is rather broad and of moderate length, its left side bulging and strongly convex. The large and somewhat variably shaped digitabulum is situated *on the left side* of the bursa. The inner partition or septum of the ductus is weak; ventrally on the right side of the ductus at its apex a very characteristic *rounded bulge* or excrescence occurs which may represent a rudimentary second digitabulum. The membranous bursa is large and globular, its point of attachment to the ductus dorsally being about halfway to the neck; ventrally it is considerably more distad and the dividing line between the chitinized and membranous portions is *very oblique*, running downward from right to left. The figure I give (fig. 1) will elucidate these characters.

Distribution. Probably occurs across the whole Dominion of Canada. I have no record of the species from the Maritime Provinces but this is most likely due

*Contribution No. 2303, Division of Entomology, Science Service, Department of Agriculture, Ottawa.

to the fact that little collecting has been done there in late May and early June when it is on the wing. In our collection there are long series of both the normal form and the form *variegata* Prout from points in Quebec province near Ottawa; a few Ontario specimens, indicating that it extends into the southern peninsula; small series from Manitoba (Winnipeg, Aweme) and Saskatchewan (Indian Head) and a long Calgary, Alberta, series from the Wolley-Dodd collection. A single male from Seton Lake and a female from 100 Mile House, are our only specimens from British Columbia; a female from the Great Slave Lake region, N.W.T., is our most northerly record. In the United States it is well-known from the New England States but of its distribution in the western states little is known; my revision records it from Easton, Wash., and I have seen a few specimens from Gothic, Colo., one before me being of the form *variegata;* when more collecting is done it will probably be found to occur in many of the Rocky Mt. areas.

From Mono and Inyo Cos., California, on the eastern side of the Sierras, I have examined a few specimens of a pale race of *ruberata* which appears worthy of a name and which I describe as follows:

H. ruberata var. **pallula** var. nov.

Male. Primaries pale whitish with a slight creamy tinge and a light sprinkling of minute smoky dots. Bands 1, 3 and 4 represented by fine black oblique lines, the latter broken somewhat between veins 2 and 4. Band 1 strongly and almost rigidly outwardly oblique; band 2 obsolescent or lacking, the antemedian space between bands 1 and 3 being faintly shaded with light brown (holotype) or almost entirely brown as in f. *variegata* Prt. (2 paratypes). Median band broad, pale, containing a thin, black discal streak. Band 4 bordered outwardly more or less distinctly with brownish, beyond which is a pale subterminal and terminal area through the centre of which typically the merest suspicion of band 5 may be traced (in the two darker paratypes this is better developed as a narrow blue-gray band). The two black subapical streaks and the apical spot stand out strongly on the pale ground-color. Fine black, broken terminal line, enlarged into small spots on each side of the veins. Fringes pale cut by smoky opposite vein-endings. Secondaries pale whitish with a light sprinkling of smoky dots. A curved and slightly crenulate, fine smoky, postmedian line and a black terminal line. Expanse 30-32 mm.

Holotype — ♂, Leevining, Mono Co., Calif., May 12, 1939 (M. L. Walton) (ex Coll. Sperry); No. 5539 in the Canadian National Collection, Ottawa.

Paratypes — 3 ♂, Bishop Cr., Inyo Co., Calif., June 9, 1935 (Walton); 1 ♂, Big Pine Cr., Inyo Co., Calif., June 17, 1937, in Coll. Los Angeles Museum and Coll. Sperry.

The pale color, especially of two of the rather worn paratypes, forms a very striking character and the whole appearance of the insect is quite reminiscent of v. *pallidata* Wgt. of *edenata;* in this latter form, however, band 5 is distinct and the genitalia, of course, are different. In the two genitalic slides made I can detect no significant differences from my *ruberata* series of slides but certainty as to the status can only be secured when females are available for examination.

Hydriomena macdunnoughi Swett

Apart from the considerably shorter palpi there seems to be no satisfactory character by which this species can be distinguished from *ruberata* as it occurs in the Ottawa region. A paratype of the species was figured in the Report of the B. C. Provincial Museum for 1918, Plate II. In the male genitalia the neck of the uncus is rather narrower and longer than is usual in *ruberata* and the size of the two curved chitinous rods from the baso-costal papillae is more as in British specimens, *i.e.*, the outer is much the thinner of the two; these differences are,

however, very slight. In the female genitalia there is practically no difference; of the two slides made (from Banff, Alta. females) the one is practically identical with my figure of *ruberata*, the other shows an entire obliteration of the excrescence on the right of the ductus – probably merely an individual variant.

Distribution. Confined, as far as is known, to the northern section of the Canadian Rockies and adjacent areas. Apart from several male specimens from the type locality, Atlin, B. C., our collection contains a good series of males taken by me at light at Nordegg, Alta., in June, 1921, and 2 ♂, 2 ♀ from Banff, Alta., caught in late June and early July. There is also a single male from Nicola, B. C. secured on May 4; this is the most southerly record of the species.

From the coastal region of Central California I have recently received several specimens which on superficial examination I was inclined to place under *ruberata*. However a closer study convinced me that they represented a good species which is described as follows:

Hydriomena feminata n. sp.

Scarcely to be distinguished in color and maculation of primaries from the paler gray forms of *ruberata* but with distinctly *shorter and less slender palpi*, this latter character due to the rougher squammation. In the holo- and allotypes the outer margin of the dark subterminal band is rather more crenulate than in normal *ruberata* but this character does not hold in the paratypes and is probably of little value. The course of band 1 is somewhat less oblique and shows none of the slight incurve below the cell and outcurve above inner margin usually present in *ruberata* but this also is a rather vague character. Apart from the palpal length the main distinguishing character is found in the female genitalia (fig. 2). Unlike *ruberata*, where the digitabulum is large and situated on the left side, in the present species the digitabulum is much *reduced in size and situated medio-ventrally* on the left side of the termination of the inner septum; the bursa is oval and rather small and the ductus bursae comparatively narrow and of moderate length. In the male genitalia such differences as exist from those of *ruberata* are rather slight; the narrow excavation between the two broad prongs of the uncus seems somewhat deeper; the base of the juxta is narrower; the two thin, curved, chitinous rods arising from the two papillae near base of costa are slightly stouter and subequal; the outer of the two papillae is smaller and bears fewer knobbed hairs; the apical portion of the aedeagus is narrower.

Holotype – ♀, Inverness, Marin Co., Calif., May 3, 1940 (E. C. Johnston); No. 5512 in the Canadian National Collection, Ottawa.

Allotype – ♂, same data (Wm. R. Bauer).

Paratypes – 1 ♂, same data as holotype; 1 ♀, same data as Allotype, in Coll. Sperry.

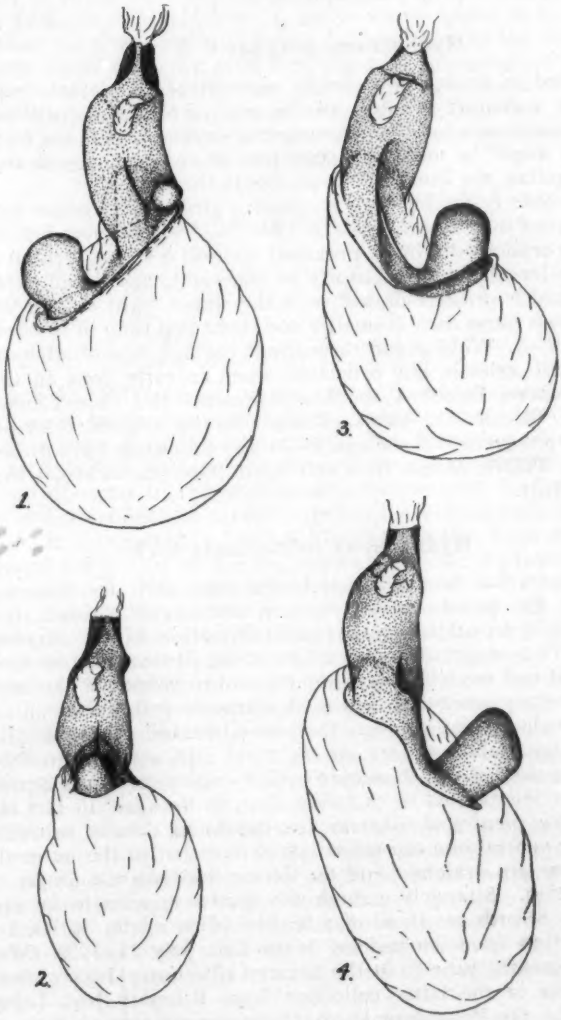
Hydriomena bistriolata Zell.

Owing to lack of material I can add little to the comments on this species and its close ally *chiricahuata* Swett made in my earlier revision, except as regards the female genitalia. A slide made from the only female of *bistriolata* in the collection (A. & M. College, Miss., Mch. 25) shows a close relationship to *ruberata*. The ductus bursae is noticeably broader with the edges straight and subparallel; it is also somewhat longer than in *ruberata*. The right-side excrescence of *ruberata* has developed into a minor digitabulum, projecting inward across the line of the septum. The main digitabulum on the left side is in the same position as in *ruberata* but is rather broader and less high; this may not prove a stable character when more material can be studied.

Hydriomena chiricahuata Swett

I have only a single female of this species before me from Prescott, Ariz. Judging by a slide of this specimen and one made from a topotypical female of *modestata* B. & McD. from Glenwood Spgs., Colo., *modestata* should be placed

PLATE XIII.



THE *RUBERATA* GROUP OF *HYDRIOMENA*

Ventral view of bursa copulatrix of 1—*Hydriomena ruberata* Frey.; 2—*Hydriomena feminata* n. sp. (Holotype); 3—*Hydriomena nevadae* B. & McD.; 4—*Hydriomena californiata* Pack.

as a northern race of *chiricahuata,* rather than, as originally described, a race of *bistriolata.* In both slides the ductus bursae is much narrower than in *bistriolata* with straight, subparallel sides; the digitabulum of the right side has again become rudimentary and moved inward towards the median line. The left digitabulum is smaller than in either *bistriolata* or *ruberata* and the line of demarcation between the chitinized and membranous portions is somewhat less oblique than in either of the other species.

Hydriomena nevadae B. & McD.

Described as a race of *ruberata,* a study of the female genitalia show *nevadae* to be a distinct species. In the male genitalia the differences in the shape of the uncus mentioned in the original description appear to hold specific value; to this might be added the fact that of the two curved rods from the baso-costal papillae, the inner one is decidedly the thicker.

The female genitalia (fig. 3) show a strong divergence from those of *ruberata* and lead over to *californiata.* The moderately long and broad ductus bursae shows parallel sides in its proximal section; a strong septum arises about midway in its length, bends abruptly to the right, and terminates in a large digitabulum which projects dorsad over the upper right section of the bursa. The membranous bursa itself is smaller and more oval than in *ruberata.*

Distribution. Wide-spread throughout the Sierras and adjacent mountain ranges. A small series in our collection taken in early June in the Keremeos region of southern British Columbia represents the only Canadian record known to me. Besides the localities noted in the original description I have records of the occurrence of the species in the following Californian counties—Placer, Fresno, Tulare, Mono, Inyo and Kern (Greenhorn Mts.), mostly in late June or early July.

Hydriomena californiata Pack.

The species has been adequately discussed and the characteristic male genitalia, with the broad, curved forks of the uncus, figured in my earlier revision. It might be added that, from information kindly furnished by Dr. Bank's, Packard's type specimen in the Cambridge Museum agrees with his figure 33 on Plate VIII and not with the figure 30, said to be that of the 'normal form'; this substantiates my contention in the above-mentioned revision.

The female genitalia (fig. 4) show a marked similarity to those of *nevadae,* the digitabulum *arising on the right side* and not on the left as in *ruberata* and its close allies. However in *californiata* the inner septum is much reduced and far less twisted to the right than in *nevadae;* in fact the organ is almost the reverse picture of *ruberata, i.e.,* the dorsal view of *ruberata* coincides closely with the ventral one of *californiata* except that in the latter the edges of the ductus bursae are straighter and the ductus itself slightly longer.

Distribution. Strangely enough the species appears to be rare in California; my only records are those of a female (slide made) in the Los Angeles Museum Collection from Tioga Pass, Mono Co., July 26, 1936 (Martin), and a male from Klamath, June 8, in the Sperry Collection. I have also examined several specimens in the latter collection from Rosmary Inn, Lake Crescent, Olympics, Wash. On Vancouver Is., B. C. the species appears to be fairly common and the specimens in our collection were nearly all taken in the region of Victoria in June and July; three specimens (2 ♂, 1 ♀) are also present from Grouse Mt., N. Vancouver.

THE CERAMBYCID BEETLE, *PHYMATODES DIMIDIATUS*, IN CEDAR STRUCTURAL TIMBERS

Adults of *Phymatodes dimidiatus* Kirby were submitted to the Canadian Forest Insect Survey (Vernon office) in mid July, 1943, by Ranger J. MacDonald of the British Columbia Forest Service, Creston. He reported the beetles to have emerged in numbers in late April from the 4- by 6-inch cedar (*Thuja plicata* Don) uprights of Mr. Hollaus' house in Camp Lister, B. C. The timbers are presumed to have been infested before being placed in the building. Some beetles emerged inside the house after they had gnawed through a layer of tarred building paper and a ½-inch thickness of "Gyproc" gypsum wall-board; others went outward through tarred paper and cedar shingles. Spencer (Ent. Soc. Brit. Col., Proc. 27:7-8. 1931) has recorded adults of the same species emerging from [Douglas?] fir beams in a house at Chilcotin, B. C.

Hugh B. Leech, Vernon, B. C.

DEATH OF GUSTAF FALKENSTRÖM

The late G. Falkenström of Stockholm, Sweden, specialist on dytiscid and haliplid water beetles, published over thirty articles, several of which are of immediate interest to American students. The following note on his life is taken from an obituary by Dr. N. Kemner, "Gustaf Falkenström och hans samlingar, som nu donerats till Entomologiska Institutionen i Lund" (Gustsaf Falkenström and his collection, now donated to the Entomological Institution in Lund), *Opuscula Entomologica* 7:108-111, with portrait. I am indebted to Per Brinck of Lund for a copy of the obituary and to Mr. F. Godber of Vernon, B. C., for a translation from the original Swedish.

Gustaf Adolf P. Falkenström was born on November 13, 1867, at Hjuleberg i Arstads, Sweden, and died in Stockholm on August 15, 1942. After the usual military service he entered the University of Lund and in a few years began a course in medicine, but became more and more interested in nature study. Taking his final examinations in May, 1898, he went the same year to the Zoologiska Institutionen, where he was associated with Aug. Quennerstedt, David Bergendahl and C. G. Thomson. At that time he studied echinoderms. Then Simon Bengtsson, under whom he worked, recommended entomology to him.

In 1899 he enered the services of an employers' association in Halsingborg. He remained with it until 1918, finally becoming a director of the organization; his duties took him to the chief places in Sweden. In 1918 he retired on a pension and it was then that he began his work on aquatic beetles, publishing his first paper in 1920. His genius showed in the excellent life-history studies of various Swedish water beetles, many of which he reared in his laboratory. Two taxonomic articles of particular interest to American students are:

1938—Some animal species-crossings in nature with analyses of similar ones in cultures, together with some fundamental questions discussed. *Genetica* 20:217-284.

1939—Beitrag zur Revision einiger Dytisciden-Gattungen, vor allem *Deronectes* Sharp und *Oreodytes* Seidlitz. *Ent. Tidskr.* 60:69-101.

Both papers are fully illustrated.

Hugh B. Leech, Vernon, B. C.

SUPPLEMENTARY NOTES ON THE NAME *COLIAS KOOTENAI* COCKLE.

In the original description of *Colias kootenai,* Cockle made no mention of the designation of disposition of type specimens. Therefore, in a recent paper in which this group of *Colias* is considered (Hovanitz, American Museum Novitates 1240), the absence of types was noted. However, T. N. Freeman informs me that types of both sexes are in existence in the Canadian National Collection and this fact is here made known. Data given on the labels are: ♂, "7.V. 1911, Kaslo, B. C., Coll. J. W. Cockle" and "*kootenai* Cockle, type"; ♀, "9.X. 1906, Kaslo, B. C., Coll. J. W. Cockle" and "*C. kootenai* Cockle, ♀ type." (Data supplied by T. N. Freeman to whom I am indebted for bringing this to my attention). This information does not alter the conclusions earlier arrived at.

William Hovanitz, California Institute of Technology.

A NOTE ON THE PERIOD OF INCUBATION OF EGGS OF THE COCKROACH *BLATTELLA GERMANICA* L.

I attempted in 1939 to gather data on the life history of this cockroach. I was carrying on similar work on the wood-roach, *Parcoblatta pennsylvanica* Deg. * and the American cockroach, *Periplaneta americana* L. †. However, *B. germanica* were so quick in their movements and escaped so easily, that I found it necessary, since my laboratory is in my home, to abandon the project. Some data were gathered, however, before the project was abandoned, on the period of incubation and the length of life of the immature roaches.

The cockroaches arrived from a dealer in New Orleans on June 13. Many of them had protruding from their bodies egg-cases, which they carry in this way for a much longer period than do the females of *Blatta orientalis* L., *Parcoblatta pennsylvanica,* or *Periplaneta americana.* In confinement, in twelve observations, I found this period to be from 6 to 16 days with an average of 10 days. In two cases the eggs hatched while the mothers were still carrying them about, and in another instance the mother carried the egg-case for 2 days after the young had left it.

In eight instances the eggs had a period of incubation of from 11 to 13 days; in 5 instances they hatched in 12 days (this is reckoned from the time the egg-cases first protruded from the body). The growth of the roaches is much more rapid than any of the three species mentioned above; the roaches from three egg-cases became adult 53, 54, and 56 days after hatching. By way of comparison I may mention that the period from hatching to the last moult is about 8 to 10 months for *B. orientalis* and for *P. pennsylvanica* and about one year for *P. americana.*

No data were got on the number of egg-cases deposited by each mother, but two mothers did deposit two egg-cases each, after an interval of 22 and 30 days respectively.

Phil Rau, Kirkwood, Missouri.

*Ent. News, 51:4-9, 33-35, 1940.
†Ent. News 51: 121-124, 151-155, 186-189, 222-227, 273-278, 1940.

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